Maximum Precision and Consistent Accuracy

Leading the way in glass industry innovation, Sklostroj recently presented a new ISS machine. Equipped with state-of-the-art automation technology, the machine has no mechanical motion couplings or application-specific control technology but instead features standardized mechatronic solutions.

For 60 years, Sklostroj Turnov CZ s.r.o., has specialized in the development and construction of industrial plants used by glass manufacturers throughout the world, and the company has emerged as a leading manufacturer of container glass machines. With around 370 employees, the Czech company has manufacturing facilities in Turnov and Znojmo for producing customer-specific solutions for the hot and cold end of the glass production spectrum. The company’s management places a strong emphasis on serving customers and has implemented a quality management system certified according to the ISO 9001-2000 standard.

All the mechanisms of the ISS machine that are directly in contact with glass are servo mechanisms. Particular attention was paid to the mold cooling, which was carefully approached and solved in a very
sophisticated way with additional servo-axes. Because the IS machine is basically a heat exchanger, this function comes first when developing a new IS machine. The machine can have from 9 to 17 servo-axes per section, depending on customer requirements and the cooling version. Also, the machine comes ready, for example, as a Triple Gob 2x5 Inch or Double Gob 6¼ Inch. Other axis distances are available as well, ranging from the Single Gob to the Quad Gob model. The machine was designed to run up to 25 cycles per minute, depending on the product. It is the most modern container-glass machine with the highest number of servo-axes in the industry.

Maintaining quality, cutting costs
This design offers massive advantages over conventional IS machines. Because all important axes are servo, a very high repeatability and consistent quality are guaranteed during the entire production process, from the beginning to the end of the job, and long start-up or adjusting times for individual sections are eliminated. All parameters are stored in a database, and therefore quick job changes and start-ups are ensured. The easily understandable HMI was important to the machine developers as well, as it would greatly simplify the operation of the system. Because all the controls and the drives are built and programmed using the Siemens systems platform, no additional software is necessary. This also improves the handling of the system in many ways and provides some cost advantages. In addition, the machine needs significantly less oil and compressed air to produce a much higher number of glass containers and therefore protects the people and the environment around the equipment in terms of noise, dust, and dirt.

The Sklostroj portfolio includes machines with various constructional designs and capacity levels, which can be adapted for the relevant operating requirements. There are variants with 4, 6, 8, 10, or 12 production sections using monoblock technology. Other models, so-called tandem machines, are equipped with up to 16 parallel stations. The smallest version is a single-gob machine with four stations. The most modern and highest-performance ISS machine of the Czech manufacturer turns out approximately 1.3 million glass containers a day using a quad-gob layout with 12 stations. As a frame of reference, this is the equivalent of what is required for manufacturers of pharmaceuticals or baby food in one day.

Highly precise motion control
With the new ISS machine, glass manufacturers achieve high throughput performance while consuming less energy. With its modular design, the machine can also be easily modified to meet customer requirements. In terms of motion control, the machines are automated using Simotion and Sinamics technology, and both areas are completely networked using Profinet technology. This means seamless real-time communication and unlimited simultaneous TCP/IP communication has been implemented. The outcome: consistently high product quality based on high-precision motion control and reproducibility.

The motion control solution ensures that all assemblies are synchronized with a high degree of precision even under extreme high-temperature manufacturing conditions. This includes the smooth gob formation of the plunger, the highly dynamic and precise cutting of individual glass gobs, the reliable provisioning of all production sections by the gob distributor, the shaping of the glass containers in the individual sections, and the synchronized discharge of the glass units to the cooling track. In addition to exact timing and the highest precision in all process steps, precise synchronization of the motion control solution also reduces wear on molds and assemblies.

Central safety control
The control and technology tasks are handled by a Simotion D445-1 CPU. An additional Simotion controller is installed at each station and the pusher. The master Simotion controller controls the machine infeed (gob distributor, shears, etc.) and sends the master axis values via Profinet IRT (isochronous real time) to the stations (slaves). The stations receive the data for various synchronous axes. The connection between Simotion and Profinet makes automated station recognition possible. This simplifies maintenance work and project management while also facilitating station upgrades.

Because safety technology has a key role to play in glass manufacturing, Sklostroj is concentrating more strongly on the related monitoring and control devices. The standard integrated safety functions in Sinamics drives mean that no additional external monitoring devices are required. The central safety control has a fail-safe PLC (S7 ET 200S Safety PLC IM151-8F) and thus achieves level D performance. All safety functions can be controlled by the Profisafe communication profile via Profinet.

Pusher system ensures smooth motion
The pusher system transfers the glass containers from the dead plate of the IS machine onto the conveyor belt. The pusher is a key component that is decisive in the performance capability of glass machines. Sklostroj was one of the first companies to develop an electronically controlled pusher system, which was patented in 1997. The new EP97-04, known as the E-Pusher, is servo-electrically driven and electronically controlled. With up to 25 cycles a
minute per station, the pusher is the most powerful on the market and is ideally suited for single- and double-gob IS machines. Depending on the glass product and the conveyor belt speeds, the E-Pusher can also be used for triple-gob applications.

The EP97-04 offers substantial advantages over conventional E-Pushers. Because the systems normally only carry out 90-degree rotations, they have only a limited ability to track the motion of products on the conveyor belt. Because of the unsynchronized operation, glass containers are repeatedly dropped and bottlenecks occur. Many pushers still rely on compressed air to move fingers forward and backward. However, leaks occur when the machines are operated with compressed air, increasing demand for air and thus driving costs up. The Sklostroj system, in contrast, ensures even motion and a high degree of reliability. This reduces the dropping of glasses and optimizes conveyor belt transport. Finger replacements can be carried out in a few easy steps with the EP97-04.

The Simotion motion control system features structured programming that has multiple benefits – especially in engineering the E-Pusher, it enables rapid and easy implementation of the application. Simotion helps achieve a start-time precision of less than 10 microseconds, which is possible only through the use of standard technology functions.

**Software modules speed up programming effort**

The setup of the E-Pusher is carried out flexibly and directly on the conveyor belt with Simatic Mobile Panels 277 IWLAN (MP277) and the WinCC graphical user interface. This also includes the curve profile design of the pusher system. The correct synchronization between forward, backward, and rotary motion is the prerequisite for the precise positioning of glass containers on the rapidly moving conveyor belt. Each pusher can be controlled with an individual acceleration profile. And each profile can be downloaded to the control during operation without causing production delays.

The E-Pushers by Sklostroj are designed as independent solutions. This gives glass manufacturers the option to replace the pushers in their existing production lines with the high-performance EP97-04 product. The modular systems are ideally suited for rapidly and easily converting existing plant equipment regardless of its configuration.

info www.sklostroj.cz